be built of many separated but interconnected strands in which the total cross section is relatively large. Named after its inventor, "Hoytether survivability" (fig. 2) is improved because it takes a larger particle to completely sever a tether built in this configuration.

For missions in which the tether safety factor can be relatively high, as in the first two Small Expendable Deployer System missions, micrometeoroid and debris survivability can be improved many orders of magnitude (fig. 3). The improved survivability can also be used as a justification for reducing the safety factor, thus lowering the weight of high-performance tether configurations.

[1]Forward, R.L. 1992. Fail-safe Multistrand Tether Structures for Space Propulsion. Twenty-Eighth Joint Propulsion Conference, Nashville, Tennessee. American Institute of Aeronautics and Astronautics, paper 92–3214.

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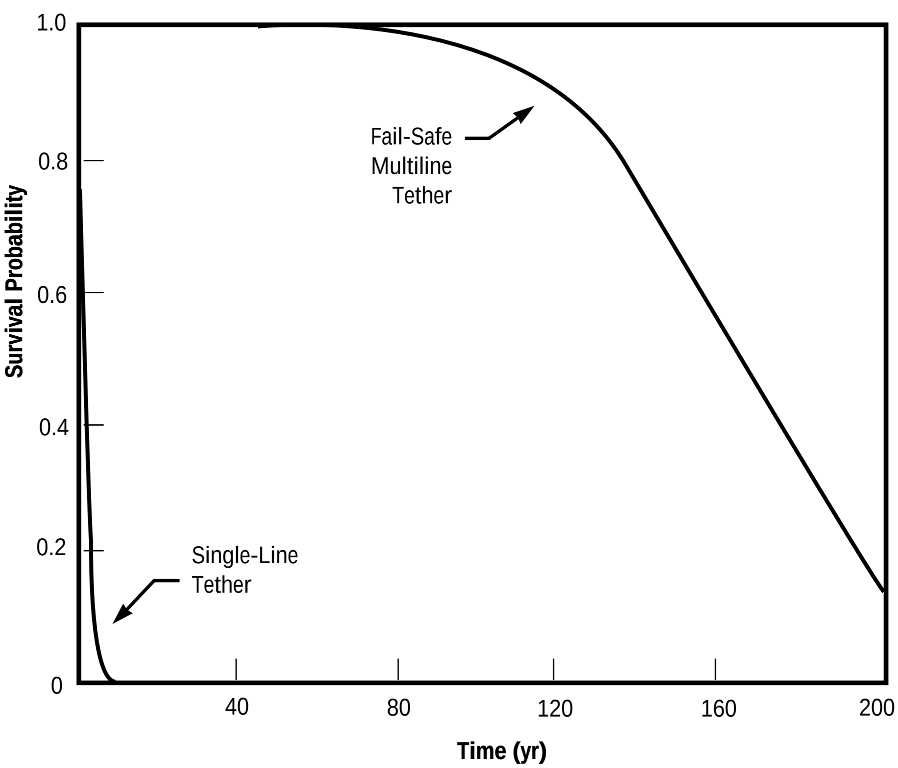

FIGURE 3.—Lifetime compensation of equal-weight, single-line and fail-safe, multiline tethers for a low-load mission.

The Magnetosphere Imager Mission

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One of the most important discoveries of the space age was that of the Van Allen radiation belts—vast clouds of intense radiation caused by the Earth and its rotating magnetic field being impacted by the supersonically expanding atmosphere of the Sun. After more than 30 years of spacecraft flights through this region, scientists now know that these radiation clouds contain electrical storms and disturbances that play important roles in the Earth's atmospheric processes. Through technology advances, pictures of this magnetospheric region can now be made, in a similar way to that of satellite photos of ordinary clouds commonly used for weather reports. Thus, NASA is poised to explore and expose the violent and variable region that surrounds our planet with entirely new types of satellite images.

For the past few years, MSFC has been studying the feasibility of flying a new generation of instruments aboard a small spacecraft to obtain such magnetospheric images. The Magnetosphere Imager mission was conceived by the NASA Office of Space Science and assigned to MSFC for further definition. The MSFC Magnetosphere Imager design team developed a mission concept to utilize a small, spin-stabilized spacecraft to carry a suite of four instruments into a high-elliptical Earth orbit for 2 years. The spacecraft will be launched by one of the new Med-Lite expendable launch vehicles and will fly over the Earth's poles to an apogee of 7 Earth radii. The mission instruments (listed in table 1) will obtain the first simultaneous global images of Earth's magnetospheric processes in multiple wavelengths of light and with energetic neutral atoms, as well as through active radio frequency sounding. In support of the technology required for the mission instruments, six advanced instrument research projects were completed in 1995 by universities, research laboratories, and industry. The results of the research were made available to NASA's Office of Space Science, Space Physics Division. Research topics are listed in table 2.

As a result of the MSFC engineering design study and the efforts of the Magnetosphere Imager science

TABLE 1.—*Strawman measurements and instrument complement for the Magnetosphere Imager mission.*

Instrument	Measurement
Hot-Plasma Imager	Energetic Neutral Hydrogen Atoms
Plasmasphere Imager	Solar Ultraviolet Light Scattered From Helium Ions at 304 Å
Far-Ultraviolet Imager	Magnetospheric Precipitation-Induced Far-Ultraviolet Light
Radio Sounder	Frequency-Swept Active Radio Frequency Sounding of the Magnetosphere

TABLE 2.—*Research for advanced technology Magnetosphere Imager instrumentation.*

Institution	Research Title
Boston University	Development and Evaluation of Multilayer Coatings for O^+ Imagers
Lockheed Palo Alto Research Laboratory	Surface Conversion Techniques for Low-Energy Neutral Atom Imagers
Lockheed Palo Alto Research Laboratory	Measurement of Precipitation-Induced Far-Ultraviolet Emissions and Geocoronal Lyman Alpha
Los Alamos National Laboratory	Ultraviolet Rejection for Low-Energy Neutral Atom Imaging
University of Iowa	Simulation of Radio Sounding in the Plasmasphere
University of Massachusetts at Lowell	Instrument Definition for a Radio Sounder for Global Magnetospheric Imaging